

WHAT IS CLAIMED IS:

- 1                    1.        A circuit board comprising:  
2                    a substrate;  
3                    a ground trace and at least one electronic component coupled to the substrate;  
4                    a conformal insulating coating disposed on the substrate to encapsulate the  
5 electronic component; and  
6                    a conductive layer vacuum metallized over the insulating coating and  
7 contacting the ground trace, wherein the grounded conductive layer forms an electromagnetic  
8 interference shield for the electronic component.
- 1                    2.        The circuit board of claim 1 wherein the conductive layer is a  
2 thermally vaporized onto the conformal insulating coating.
- 1                    3.        The circuit board of claim 2 wherein the vacuum metallized layer  
2 comprises aluminum, copper, silver, gold, tin, nickel, or chromium.
- 1                    4.        The circuit board of claim 2 wherein the vacuum metallized layer has a  
2 thickness between approximately one micron and fifty microns.
- 1                    5.        The circuit board of claim 1 further comprising a conformal layer  
2 disposed over the conductive layer, wherein the conformal layer can protect the metallized  
3 layer and electrically isolate the metallized layer from adjacent components.
- 1                    6.        The circuit board of claim 5 wherein the conformal layer comprises  
2 acrylic, urethane, one-part epoxy, or two-part epoxy.
- 1                    7.        The circuit board of claim 5 wherein the conformal layer is waterproof.
- 1                    8.        The circuit board of claim 1 wherein the ground trace is positioned at  
2 least around a periphery of the substrate.
- 1                    9.        The circuit board of claim 1 wherein the at least one electronic  
2 component comprises a first and second component, wherein the ground trace runs between  
3 the first and second component.
- 1                    10.      The circuit board of claim 9 wherein the insulating layer comprises a  
2 first and second insulating layers and the conductive layer comprises a first and second

conductive layer, wherein the first electronic component encapsulated by the first insulating layer and first conductive layer and the second component is encapsulated by the second insulating layer and second conductive layer, wherein both the first and second conductive layers contact the ground trace.

11. The circuit board of claim 1 further comprising a dam on the substrate, wherein the ground trace is positioned on the dam.

12. The circuit board of claim 1 wherein the substrate is flexible.

13. A method of EMI shielding a circuit board or flexible circuitry, the method comprising:  
encapsulating an electronic component with a conforming insulating base coating;  
applying a first conductive layer over the base coating; and  
grounding the conductive layer to a ground trace to form an EMI shield for the electronic component.

14. The method of claim 13 wherein applying comprises vacuum metallizing the first conductive layer over the insulating coating.

15. The method of claim 14 further comprising maintaining a temperature of the component and base coating below approximately 200°C during vacuum metallizing.

16. The method of claim 13 wherein the first conductive layer comprises aluminum, copper, silver, gold, tin, or nickel-chromium.

17. The method of claim 13 further comprising applying a second conductive layer over the first conductive layer

18. The method of claim 13 further comprising applying an insulating conformal layer over the first conductive layer.

19. The method of claim 18 wherein the conformal layer is waterproof.

20. The method of claim 13 wherein applying comprises adhering the conductive layer using a glow discharge process.

1                   21.     The method of claim 13 further comprising positioning the ground  
2 trace around a periphery of the component.

1                   22.     The method of claim 13 wherein the ground trace is disposed between  
2 a first and second component.

1                   23.     The method of claim 13 further comprising exposing the ground trace  
2 through the insulating coating.

1                   24.     A flexible circuitry comprising:  
2 a flexible substrate;  
3 a ground trace and a circuit coupled to the flexible substrate;  
4 a conformal coating attached to the flexible substrate over the circuit; and  
5 a conductive layer disposed over the conformal coating and contacting the  
6 ground trace, wherein the grounded conductive layer forms an electromagnetic interference  
7 shield for the flexible circuitry.

1                   25.     The flexible circuitry of claim 24 wherein the flexible substrate  
2 comprises polyimide, Kapton or polyimide.

1                   26.     A circuit board comprising:  
2 a substrate;  
3 a ground trace and at least one electronic component coupled to the substrate;  
4 and  
5 a thermoform comprising a vacuum metallized conductive layer, wherein the  
6 thermoform can be disposed over the electronic component and coupled to the ground trace.

1                   27.     The circuit board of claim 26 wherein the vacuum metallized  
2 conductive layer is applied through thermal vaporization.

1                   28.     The circuit board of claim 26 wherein the vacuum metallized  
2 conductive layer has a thickness between approximately one micron and fifty microns.

1                   29.     The circuit board of claim 26 wherein the thermoform is coupled to the  
2 ground trace with a conductive adhesive.

1                   30.     The circuit board of claim 29 wherein the conductive adhesive is a  
2     conductive adhesive strip that substantially conforms to a shape of the ground trace.

1                   31.     The circuit board of claim 30 wherein the thermoform further  
2     comprises a plurality of compartments, wherein the components are separated within the  
3     compartments to prevent cross-talk between the components.

1                   32.     The circuit board of claim 31 wherein the thermoform comprises a  
2     peripheral lip and wherein the plurality of compartments define a plurality of walls, wherein  
3     the plurality of walls and peripheral lip contact the ground trace.

1                   33.     The circuit board of claim 26 wherein the vacuum metallized layer  
2     comprises a thickness between 1.0 microns to 50.0 microns.

1                   34.     The circuit board of claim 26 wherein the vacuum metallized layer  
2     comprises aluminum, copper, tin, nickel, chromium, silver, or gold.

1                   35.     A method of shielding electronic components, the method comprising:  
2     vacuum metallizing a conductive layer onto a thermoformed article;  
3     attaching the vacuum metallized thermoform to a ground trace on a circuit  
4     board to form a grounded shield.

1                   36.     The method of claim 35 further comprising:  
2     thermoforming a plurality of compartments into the thermoform; and  
3     separating the electronic components into separate compartments of the  
4     thermoform so as to prevent cross-talking between the electronic components.

1                   37.     The method of claim 36 wherein attaching comprises coupling a  
2     conductive adhesive between the thermoform and the ground trace.

1                   38.     The method of claim 37 wherein coupling comprises dispensing the  
2     conductive adhesive onto one of the thermoform and the ground trace.

1                   39.     The method of claim 37 wherein coupling comprises screen printing  
2     the conductive adhesive on an attachment portion of the thermoform.

1                   40.     The method of claim 37 wherein the conductive adhesive is a  
2 preformed adhesive strip.

1                   41.     A shielded circuit board comprising:  
2                   a substrate comprising a ground trace;  
3                   at least a first and second electronic component disposed on the substrate; and  
4                   a substrate body comprising a vacuum metallized conductive layer, wherein  
5 the thermoform body comprises attachment surfaces that can be coupled to the ground trace;  
6                   wherein the substrate body comprises a first and second compartment such  
7 that when the attachment surfaces are coupled to the ground trace, the first electronic  
8 component is disposed in the first compartment and the second electronic component is  
9 disposed in the second compartment.

1                   42.     The shielded circuit board of claim 41 further comprising a conductive  
2 adhesive disposed between the attachment surfaces and the ground trace.

1                   43.     The shielded circuit of claim 41 wherein the first and second  
2 compartments are defined by a plurality of outer walls and an inner wall, wherein the inner  
3 wall contacts the ground trace between the first and second components.

1                   44.     The shielded circuit of claim 41 wherein the substrate body is a  
2 thermoform.

1                   45.     The shielded circuit of claim 41 wherein the substrate body comprises  
2 injection molded plastic.

1                   46.     A method of shielding electronic components on a circuit board, the  
2 method comprising:  
3                   providing a vacuum metallized substrate comprising a plurality of  
4 compartments;  
5                   coupling attachment surfaces of the metallized substrate to a ground trace on a  
6 circuit board with a conductive adhesive; and  
7                   separating electronic components into the compartments of the metallized  
8 substrate so as to prevent cross talk between the electronic components.

1 47. The method of claim 46 wherein the substrate comprises one of a  
2 thermoform and injection molded plastic.

1 48. The method of claim 46 wherein coupling comprises contacting an  
2 attachment surface against the ground trace between the electronic components.

1 49. The methods of claim 46 wherein the attachment surfaces completely  
2 surround the electronic components.

1 50. An EMI radiation shield for a circuit board, the shield comprising:  
2 a metallized substrate body comprising a base portion, and a top portion  
3 removably attached to the base portion;  
4 wherein the base portion comprises an attachment surface that can be bonded  
5 to a ground trace on the circuit board.

1 51. The EMI shield of claim 50 further comprising a conductive adhesive  
2 that can bond the attachment surfaces to the ground trace.

1 52. The EMI shield of claim 50 wherein the base portion and top portion  
2 are coupled to each other through an connection assembly.

1 53. The EMI shield of claim 52 wherein the connection assembly  
2 comprises a tab and groove, wherein one of the tab and groove is on the base portion and the  
3 other of the tab and groove is on the top portion.

1 54. The EMI shield of claim 52 wherein a periphery of the top portion  
2 overlaps a periphery of the bottom portion.

1 55. The EMI shield of claim 54 wherein at least one of the periphery of top  
2 portion and bottom portion comprises protrusions.

1 56. The EMI shield of claim 55 wherein the protrusions are spaced no  
2 farther than one-half a wavelength of the EMI radiation.

1 57. The EMI shield of claim 52 wherein the substrate body comprises a  
2 thermoform.

1                   58.     The EMI shield of claim 52 wherein the substrate body comprises  
2 injection molded plastic.

1                   59.     A method of shielding an electronic component, the method  
2 comprising:  
3                   attaching a base portion of a metallized substrate to the ground trace  
4 surrounding the electronic component; and  
5                   removably coupling a top portion of a metallized substrate to the base portion  
6 to cover the electronic component.

1                   60.     The method of claim 59 further comprising positioning a conductive  
2 adhesive over at least a portion of a ground trace.

1                   61.     The method of claim 59 wherein coupling comprises overlapping a  
2 portion of the top portion over the bottom portion.

1                   62.     The method of claim 59 wherein the top portion overlaps the bottom  
2 portion over a periphery of the bottom portion.

1                   63.     The method of claim 59 further comprising position protrusions  
2 between a periphery of the top portion and bottom portion of the EMI shield.

1                   64.     The method of claim 63 wherein the protrusions are spaced no larger  
2 than one-half a wavelength of electromagnetic radiation emitted from the electronic  
3 component.

1                   65.     The method of claim 59 wherein coupling comprises inserting a tab in  
2 a groove, wherein one of the tab and groove is disposed on the top portion and the other of  
3 the tab and groove is disposed on the bottom portion.

1                   66.     The method of claim 59 further comprising thermally evaporating a  
2 conductive layer onto the thermoform.

1                   67.     The method of claim 59 wherein the substrate body comprises one of a  
2 thermoform and injection molded plastic.

1                   68.     An EMI shield for components of a PCB, the shield comprising:

2 a substrate;  
3 a ground trace and at least one electronic component coupled to the substrate;  
4 and  
5 a mold injected plastic substrate comprising a vacuum metallized conductive  
6 layer, wherein the mold injected plastic substrate can be disposed over the electronic  
7 component and coupled to the ground trace.

1 69. The circuit board of claim 68 wherein the mold injected plastic is  
2 coupled to the ground trace with a conductive adhesive.

1 70. The circuit board of claim 69 wherein the conductive adhesive is a  
2 conductive adhesive strip that substantially conforms to a shape of the ground trace.

1 71. The circuit board of claim 70 wherein the mold injected plastic further  
2 comprises a plurality of compartments, wherein the components are separated within the  
3 compartments to prevent cross-talk between the components.

1 72. The circuit board of claim 71 wherein the mold injected plastic  
2 comprises a peripheral lip and wherein the plurality of compartments define a plurality of  
3 walls, wherein the plurality of walls and peripheral lip contact the ground trace.